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# GEOPHYSICAL ABSTRACTS[1]

## No. 8

Compiled by Frederick W. Lee[2]

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## 1. GRAVITATIONAL METHOD

### DIE REDUKTION DER KOINZIDENZZEITEN VON PENDELN ZUR BERECHNUNG VON SCHWEREDIFFERENZEN

### (CORRECTION OF COINCIDENCE MOMENTS OF PENDULUMS FOR THE CALCULATION OF GRAVITY DIFFERENCES)

By H. Schmehl

Zeitschrift fuer Geophysik, Heft I, 1929, pp. 1-16.

The most common proceedings for calculating the correction of gravity observations made by pendulums such as the determination of the observed time of oscillations of a pendulum from the observed coincidence moments, the reduction of the observed times of oscillation to equal ratios, and the calculation of the relative gravity from the reduced differences of the time of oscillations, are replaced by reduction of the observed coincidence moments to equal ratios and calculation of relative gravity from the reduced differences of the coincidence moments. The reduction formulas are usually derived for the reduction of observations of 1/i second pendulums. In addition to the one-pendulum proceeding, the two-pendulum proceeding is taken into consideration also. Numerical examples serve for the explanation of the correction.--Translation of the author's abstract.

### BEITRAG ZU FRAGE DER BEWERTUNG DER VERSCHIEDENEN SCHWERESTOERUNGEN

### (CONTRIBUTION TO THE QUESTION OF THE ESTIMATION OF VARIOUS GRAVITY DISTURBANCES)

By Johannes Wilhelm

Abhandlungen der Preussischen Geologischen Landesanstalt,
Berlin, Heft 10, 1928, 50 pp.

The fact that the evident mass anomalies in the subsoil are more or less compensated by isostasy is at the present time indisputable. This distribution of masses is in general proved by gravity measurements. There are two hypotheses by which the manner of compensation is explained: Pratt's hypothesis and Airy's hypothesis. Attempts based on gravity measurements to reach a common definition of the hydrostatic system, as given by Pratt or Airy, have failed. To make a decision between Pratt and Airy based on gravity measurements only seems to be impossible at the present time.

The correctness of the isostatic method of reduction as concerns the exact definition of the hydrostatic system, however, must be considered to be no higher than that of ordinary methods of reduction.

Defects of the isostatic method of reduction depend in the first place on the number and kind of hypothetical assumptions. The importance of the Bouguer anomaly is still maintained, although the direction is different. The diagnosis of the conditions of the masses in the uppermost zones at the earth's sectors is completed by geological interpretation of the gravity anomalies. From this the value of the gravity disturbances necessary for the geologist must be derived. It results that the gravity anomalies provide for the geologist indications on the regional conditions of the masses at great depths on the largest tectonic unities. Local mass disturbances, observed very close to the surface, which can directly be investigated in a geological way, are not involved in the gravity measurements. This circumstance must be considered to be of great advantage. The gravity measurement is very suitable for the first preparatory work necessary for the systematic economic exploration of deposits of large areas.

A long list of literature is added.--Author's abstract, translated by W. Ayvazoglou.

## COMPARISON OF TORSION BALANCE AND GEOLOGIC INTERPRETATIONS OF OUTLINE OF BLUE RIDGE SALT DOME

By Jack Logan

The Oil Weekly, Vol. 55, No. 4, Oct. 11, 1929, pp. 37-41.

After mentioning a series of oil discoveries made with the torsion balance in the Gulf Coast fields since 1923, and dwelling especially on the three commercial wells completed since August 15, 1929--the Esperon Domes and the Mykawa well, the first two daily producing 400 barrels of oil from a depth of 3,304 to 3,320 feet and 175 barrels from a depth of 2,270 to 2,276 feet, and the third producing gas from a depth of 4,189 feet--Logan describes the torsion balance survey of the Blue Ridge Dome, Fort Bend County. The results of the work are shown in curves and maps. A graphic comparison of the torsion balance and geologic interpretations of the outline of the dome is given.

The torsion balance survey was made in 1925 by the North American Exploration Co. The results of that torsion balance survey were worked into the accompanying drawings along with the geologic section by John F. Weinzierl of Houston. A map of leases and ownerships with the producing wells around the dome, forming a near-circle, is given.

The dotted curve shows the outline of the dome as revealed through the torsion balance survey. The torsion balance outline shown on the ownership map is a projection on it of the gradient map shown in another figure.

Figures showing "gradient curves" and "geologic sections" reveal the close conformity between the shape of the dome as shown by the logs of wells and through the torsion balance work.

The torsion balance interpretation of the outline of the dome conforms with startling accuracy to the geologic interpretation.

A brief description of the torsion balance work and the principles upon which it is based are given in the article.--W. Ayvazoglou.

## ASTRONOMERS COMPLETE GRAVITY COMPARISON

### Editorial Note

Canadian Mining Journal, No. 41, Oct. 11, 1929, p. 960.

A series of pendulum observations at base stations in Europe and America has been completed by the Dominion Observatory in Ottawa. This work is considered to be the most accurate gravity comparison ever made between the two continents.

The selected stations were: The Dominion Observatory, Ottawa, which is the gravity base for Canada; the Royal Observatory, Greenwich, the base for Great Britain; the Geodetic Institute at Potsdam, Germany, the base station to which all gravity stations throughout the world are referred; and the Coast and Geogetic Survey Office, Washington, the base for the United States.

The purpose of the work was to determine the gravity relation that exists between Ottawa and the bases mentioned.

From the scientific point of view, the results of the work are important in connection with the question of the shape of the earth as well as of the general equilibrium of the earth's crust.

According to the results of the determinations, the general equilibrium is found to be more complete and the equator more nearly circular than previous international gravity observations would indicate.

From the practical point of view the determination of gravity has been found to be important in the discovery of minerals and the tracing of geological structure.

The determinations were made by allowing a pendulum to swing freely in an air-exhausted chamber for a period of two weeks and determining accurately at each place how much the pendulum lost or gained. It was found that on taking the pendulum from Ottawa to Greenwich the pendulum gained about 2 minutes and 50 seconds per week; at Potsdam, about 3 minutes and 42 seconds; at Washington it lost about 2 minutes and 36 seconds in the same time. The comparative values of gravity at the four bases have been determined from these results.--W. Ayvazoglou.

## 2. MAGNETIC METHODS

## CONTROL AND ADJUSTMENT OF SURVEYS WITH THE MAGNETOMETER OR THE TORSION BALANCE

By Donald C. Barton

Bulletin of the American Association of petroleum geologists,
vol. 13, No. 9, September, 1929, pp. 1163-1187.

Some degree of residual error is present in practically every observation made with a magnetometer or a torsion balance. Errors of some types can be avoided, or greatly reduced, by careful technique of observation. Other errors can be reduced by the application of corrections, but in general some residual error will persist. Errors in isolated or widely separated observations, or, in general, in single lines of stations, are not detectable or at least are not easily evident. But if the stations are so placed that there are closed circuits of observations, the errors generally produce more or less discordance.

Adjustment of mutually discordant systems, or sets of stations, is necessary for their satisfactory use for all but the rougher interpretations. The adjustment gives a probable value for each station with due regard to all of the observations more or less mutually affecting it. Various types of control and adjustment are in use. The method of least-square adjustment is the most accurate of the methods of adjustment, but requires at least moderate mathematical skill and is distinctly tedious. But for the degree of accuracy in commercial geophysical work in oil geology, certain approximate schemes of least-square adjustment can be cast in simple tabular forms which are easy to use and which require no knowledge of higher mathematics.--Author's abstract.

## SIMPLE MAGNETIC METHOD FOR ORE PROSPECTING

By Hans Lundberg

Canadian Mining and Metallurgical Bulletin, July, 1929, 9 pp.

The present article is an attempt to help the prospector regain interest in the magnetic instruments and to show the use and application of a simple magnetic survey; most articles written on magnetic methods of prospecting are generally too elaborate and technical for the average prospector and thus have caused a great deal of disappointment.

Simple methods are investigated and an analysis is made of the results obtained by these methods.--W. Ayvazoglou.

## THE VARIATION OF MAGNETIC ANOMALIES

By W. N. McFarland

Terrestrial Magnetism and Atmospheric Electricity,
vol. 34, No. 2, June, 1929, pp. 143-146.

This paper describes briefly a method of isogonic-chart construction, and the distribution of station anomalies, or differences of observed values from the average condition shown by the chart. The distribution is shown to be according to the law of occurrence of accidental errors. The available data are given in a table, and a figure shows the correspondence of observational data and theoretical curve in an individual case.--Author's abstract.

## THE MAGNETO-CHRONOGRAPH AND ITS APPLICATION TO MAGNETIC MEASUREMENTS

By H. E. McComb and C. Huff

Terrestrial Magnetism and Atmospheric Electricity,
vol. 34, No. 2, June, 1929, pp. 123-141.

The period of a magnet oscillating under the directive force of the earth's magnetic field is a function of the strength of that field. Heretofore the estimation of the period has been accomplished by eye and ear readings, but in the present method the personal equation is entirely eliminated. Light from an intense source such as an automobile headlight lamp is condensed on the glass-scale end of a magnetometer magnet, and afterward reflection is focused on a slit in front of a photo electric cell. The reflected beam acts as an optical lever whose period is the same as that of the magnet but whose amplitude is twice as great. At each transit of the image across the slit, current is passed by the cell, and after passing through amplifiers is made to operate a pen on a chronograph.

A chronometer in the circuit marks seconds on the record by the same pen. In this investigation the method was applied in the determination of the moment of inertia of a magnotometer magnet, estimation of personal equation in eye-and-ear readings, and in preliminary tests of the relative absolute magnetometer.--Author's abstract.

## THE MAGNETIC FIELD OF BODIES OF REGULAR SHAPE FROM THE VIEWPOINT OF MAGNETOMETRIC STUDIES

(In Russian)

By J. Bahurin

Bulletin of the Institute of Practical Geophysics,
Leningrad, No. 4, 1928, pp. 1-79.

This paper is a continuation of the article printed in issues Nos. 2 and 3 of the same bulletin (See Geophys. Abs. 1).

Chapter III deals with the "Oblate ellipsoid of revolution magnetized by forces not parallel to the axis of rotation (oblique magnetization)." The author concludes from the theoretical calculations that an oblate ellipsoid of rotation and an elliptical cylinder with an infinitely long axis are magnetized equally if the sections along the axis of rotation of the ellipsoid and that perpendicular to the axis of the cylinder are similar.

In the further part of this chapter Bahurin examines the questions and derives formulas concerning the following items:

1. The distribution of the magnetism along the surface of the ellipsoid.

2. The value of the horizontal component of the intensity of magnetization.

3. The potential and the component forces of the action of the oblate ellipsoid of rotation in case of oblique magnetization.

4. The changes of the horizontal component in the XOZ plane (in case of negative X and positive X).

5. The changes of the vertical component in the XOZ plane (in case of positive X and negative X).

6. The changes of the vertical and horizontal components in the ZOY plane.

7. The triaxial ellipsoid.

Many tables are included in the article.--W. Ayvazoglou.

## ANOMALIES OF VERTICAL INTENSITY COMPARED WITH REGIONAL GEOLOGY FOR THE STATE OF CALIFORNIA

By George B. Somers

The Colorado School of Mines Magazine,
Sept., 1929, pp. 22-28.

The article is a preliminary report prepared by the author for the purpose of obtaining information regarding methods of procedure and the possibilities of utilizing the data available for a thesis on the correlation of the anomalies of vertical intensity with the regional geology of North America.

After a brief description of the morphological conditions in California and of the statigraphy and formations of rocks, the author gives an outline of the geological history of the following regions: 1. Basin and range; 2. Sierra Nevada; 3. California valley, and 4. Coast range region.

The source of information of the magnetic stations in California was the map of the western half of the United States which showed the vertical intensity of the magnetic stations of the region based on data obtained in 1925.

As this map gave only the actual vertical intensity at each station, in order to show the true anomalies it was necessary to make a correction for the changes in vertical intensity due to changes in latitude and longitude.

The method of doing this, selected by the author, is described. A table showing the magnetic correction for latitude and longitude for 158 stations is given. The conclusions drawn by Somers are summed up as follows:

1. The method used in eliminating the natural increase in vertical intensity from south to north and from west to east was satisfactory for this State, though it probably would not be for a larger area. The anomalies were of such magnitude that errors of considerable size would not have changed the results.

2. The regional structure appears to have been brought out to a considerable extent but would undoubtedly have been shown better if the results could have been obtained from a larger number of stations.

3. The producing oil fields are not indicated by the isonomalies, due probably to a shortage in the number of stations.

4. Since similar magnetic and structural conditions appear to exist to the north of the present fields, the possibility of additional fields in that direction is promising.

5. Assuming that the stratigraphy is similar to that in the producing areas, the indications appear to be favorable for additional oil pools along the center line of the California valley.

6. It is once more shown that the correct interpretation of geophysical data depends to a great extent on the study of geological conditions.

7. It is possible to obtain considerable data regarding the regional geology by geophysical methods.

A map showing the isonomalics of vertical intensity of the State of California is given.--W. Ayvazoglou.

## MAGNETIC SURVEY IN THE REGION OF NEFTE-CHALA

(In Russian)

By A. J. Zaborovsky

The Petroleum Industry (Moscow),
vol. 16, No. 5, May, 1929, pp. 643-654.

Magnetic anomalies in the regions of oil deposits in Azerbeidjan were established by investigations made during 1926, 1927, and 1928.

These anomalies were found to be due to the presence of magnetic minerals, especially magnetite, in the rocks composing the oil-bearing regions. Zaborovsky gives a table of the distribution of the magnetic minerals in the region examined. The figures of the table show the relative content of the magnetic minerals in the rocks; their absolute amount in the rocks is very small, about 1 per cent on the average, although this amount increases in some places to 35 per cent.

In order to establish the geological structure of the region in places where the direct geologic investigation could not be made, the presence of this magnetic mineral was utilized for accomplishing the magnetic survey. The author describes the two types of instruments used in modern magnetometry for studying anomalies of the order from 100 to 200 $\gamma$: (1) The magnetic theodolite and a sensitive dip circle provided with a needle, or an induction dip circle, and (2) The local variometer of various construction.

After comparing the advantages and disadvantages of the work with one or the other type of instruments, the author expresses himself in favor of the work with the local variometer and gives a description of the principles, construction, and the use of different types of variometers.

An expedition was formed by the Governmental Oil Research Institute for a detailed magnetic survey in the region of Nefte-Chala in 1928. The expedition was provided with four variometers, two for the determination of the horizontal intensity and two for the determination of the vertical intensity. The instruments were adjusted in accordance with the conditions of the work in the region.

The region of Nefte-Chala is situated near the mouth of the river Kura on the peninsula bounded on one side by the Caspian Sea and on the other by the Kisil-Agach Bay (Caucasus).

The preliminary magnetic investigation performed in 1927 has shown that the zone of magnetic anomalies runs in the direction from southeast to northwest.

Zaborovsky gives a series of diagrams and maps showing the distribution of the components of the magnetic field, on which he bases his summary of the results of the magnetometric survey of the region, as follows:

1. The magnetic anomalies in the region of Nefte-Chala are in strict relation with the geological structure of the region;

2. The character of these anomalies, if they are caused by the presence of magnetite in the Tertiary deposits, shows that:

    A. There is in this region an anticline extending in the direction from southeast to northwest;

    B. The line of the axis of the anticline passes to the east of pit-hole 5;

    C. The arch of the anticline sinks gradually toward the southeast;

    D. The northeastern wing of the anticline has a smaller angle of dip than its southwestern wing; and

    E. To the southeast of the line of pit-holes the arch of the anticline rises again. -- W. Ayvazoglou.

## 3. SEISMIC METHODS

### GEOPHYSICAL FOUNDATION STUDY BY EXPLOSION-WAVE METHOD

By A. T. Parsons

Engineering News-Record, Feb. 14, 1929, pp. 273-275.

Parsons mentions the possibilities of applying seismic methods of geophysical prospecting in making foundation explorations at proposed sites for dams, bridges, or buildings.

The explosion-wave method, as it is developed in oil-field work, is described by the author in the article. Several figures showing typical time-travel record and explosion-wave paths from single and successive shots are given.

During the past two years Parson's organization has made subsurface foundation surveys of several hundred square miles in various parts of California. Where it has been possible to compare the results with actual drilling, a close agreement has been observed.--W. Ayvazoglou.

### UBER FORTPFLANZUNG VON ELASTISCHEN WELLEN IN VISKOSEN MEDIEN

### (ON THE PROPAGATION OF ELASTIC WAVES IN VISCOUS MEDIUMS)

By B. Gutenberg

Physikalische Zeitschrift, vol. 30, No. 8, 1929, pp. 230-231.

According to the theoretical conclusions made by Sezawa, elastic waves become gradually longer and more level during their propagation in viscose mediums. The author finds that under certain suppositions the law of propogation may be written as follows:

Period $T = \sqrt{T_0^2 + CD}$ in which D is the distance and C the constant for the material in question.

This relation has proved to be correct for a series of geophysical proceedings, especially for the propagation of waves of seismic disturbances of the soil, earthquakes, artificial shakings, sea waves, and also correct qualitatively for sound waves, where quantitative results are not available.--Author's abstract.

## 4. ELECTRICAL METHODS

### ELECTRICAL SUBSOIL EXPLORATION AND THE CIVIL ENGINEER

By Irving B. Crosby and Sherwin F. Kelly

Engineering News-Record, Feb. 14, 1929, pp. 270-273.

The adaptation of modern geophysical procedures to important requirements of civil engineering construction is outlined.

The authors describe the practical application of electrical exploration to certain foundation problems, demonstrating how effectively it may be used for the investigation of bedrock concealed by overburden.

The demonstration of the method was arranged at eight preexisting borings, and the electrical observer was kept in ignorance of the conditions already encountered in the course of drilling. The results were checked with the drill records and found to be satisfactory.

The results of some of the determinations are described in the article as representative examples. Various graphs show the resistivities calculated as a function of depth.

The average accuracy in 10 of the electrical determinations that were directly checked by the drill is shown in the table given below:

Table 1. - Results of electrical determinations directly checked by the drill

| Hole No. | True depth to rock, feet | Predicted depth, feet | Predicted depth in relation to the true depth, per cent |
|---|---|---|---|
| 1 | 29 | 24 | 83 |
| 7 | 27 | 41 | 151 |
| 9 | 108 | 108 | 100 |
| 10 | 100 | 118 | 118 |
| 11 | 56 | 53 | 95 |
| 12 | 50 | 43 | 86 |
| 13 | 101 | 105 | 104 |
| 14 | 142 | 145 | 104 |
| 20 | 167 | 115 | 69 |
| 21 | 147 | 142 | 97 |

Following the tests an extensive exploration campaign was undertaken. The results are not made public, but the campaign provides a basis for cost estimates.

Two areas, totaling 250 acres, were surveyed by establishing about 200 points of observation.

From one to three determinations could be made at a cost of $50 to $100 per position.

The total cost of the survey to the construction company was not much more than that of one drill hole in which much trouble was caused by bowlders.

The authors conclude that the example cited proves the possibility of the application of electrical methods to a specific foundation problem.

As far as the authors are aware, this was the first time that the geophysical method of prospecting has been commercially applied in solving civil engineering problems.

The geophysical method of prospecting was applied last spring to the study of two dam sites on the Connecticut River near Littleton, N. H.--A. Ayvazoglou.

## EQUIPOTENTIAL LINES OF A NATURAL ELECTRIC FIELD PRODUCED BY A SPHERICAL ORE-BODY

(In Russian)

By A. Petrowsky

Bulletin of the Institute of Practical Geophysics, Leningrad, No. 4, 1928, pp. 81-89.

In two previous articles, "Natural electric field produced by ore" and "Determination of the location, depth, and thickness of a spherical ore body by observing the earth current produced" (see Geophys. Abs. 1), Petrowsky constructed graphs showing the changes of the potential gradient which occurred in case the observer was moving across the region situated above the ore body.

In addition to these graphs the present article deals with methods of calculation and construction of graphs showing the equipotential lines produced on the earth's surface due to the action of a spherical ore body.

Calculation is made for three cases:

1. For the vertical position of the axis of polarization ($\alpha = 0^\circ$).
2. For an inclined position of the axis of polarization ($\alpha = 45^\circ$).
3. For the horizontal position of the axis of polarization ($\alpha = 90^\circ$).

According to these graphs:

In the first case ($\alpha = 0^\circ$), the equipotential lines of a natural electric field of a spherical ore body are circles, the center of which lies above the center of the ore body.

In the second case ($\alpha = 45^\circ$), a deformation of the curves takes place; the maximum of the potential shifts somewhat forward and the positive equipotential lines are shifted forward at the same time.

In the third case ($\alpha = 90^\circ$), the position of the equipotential lines becomes symmetrical with respect to the axis of ordinates.

The corresponding tables used for the construction of the graphs are added to the article.--W. Ayvazoglou.

## MAGNETIC FORCES IN AN ARTIFICIAL ELECTRIC FIELD

(In Russian)

By A. Petrowsky

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1928, pp. 92 - 119.

In his article "Calculations of an artificial electric field" (see Geophys. Abs. 1), Petrowsky derived formulas for the calculation of potentials and projections of the electric force and showed the methods for calculating them. The present article presents formulas for calculating projections of the magnetic force, as well as the corresponding methods of these calculations.

The mathematical analysis of a magnetic field produced on the surface of the earth by leading-in of the current through one electrode has already been given by Koenigsberger (Das magnetische Feld einer Stromquelle im Raum, Physikal. Ztschr., vol. 28, No. 9, 1927, pp. 342-344. Petrowsky examines a more general case, that of a magnetic field produced at any point in space, the system of coordinates being changed accordingly.

Using the principle of superposition of fields, Petrowsky derived formulas by which the magnetic force on the surface of the earth in Schlumberger's, Petrowsky's and Lundberg's fields could be calculated.

The last part of the article gives the methods of calculation of the magnetic forces in Petrowsky's field.

Four numerical examples, completed by two tables, illustrate the proceeding of the calculation. The use of the tables considerably shortens the time necessary for calculations. The article is provided with five figures.--W. Ayvazoglou.

## ELECTROMETRIC INVESTIGATION OF THE UPPER ARSHINSK ORE-BED ACCOMPLISHED IN THE SUMMER OF 1927

(In Russian)

By A. Petrovsky

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1928, pp. 121 - 143.

Valuable results obtained from the electrometric investigation of the Upper-Arshinsk ore bed accomplished in the summer of 1926 (see Geophys. Abs. 1) caused the continuation of the work in the summer of 1927.

Contents of the article:

1. The object of the expedition.

2. Preparation for the expedition.
3. Changes made in the stations.
4. Changes concerning the feeding network.
5. Auxiliary instruments.
6. Changes in the receiving devices.
7. A field bridge for resistance measurement.
8. Electrodes of the bridge and the method of measuring resistances of the rocks on the spot.
9. Area of the work.
10. Cutting of the area into sections.
11. Electrical surveying.
12. Classification of the anomalies. Importance of the specific conductivity of the rocks.
13. Influence of topography.
14. Influence of meteorological conditions.
15. Conclusion.

Work on the following details was included in the plan:

A. Definition of the changes in the course of the equipotential lines caused by the difference of the specific conductivity of the upper layers of the soil.

B. Establishment of topographic influence upon the course of the equipotential lines.

Changes made with regard to generator sets, rods, arrangement of the field bridge, as well as the new bridge itself, are given in figures.

The work of the expedition began from the last station of the previous year, and new stations were added by extension.

The position of the stations is given in a figure. A considerable amount of numerical data has been obtained, but the working out of it is of course delayed, as supplementary investigations in the laboratory are required. However, the authors give in the article several conclusions based on the preliminary examination of the data; they are:

1. The electric field observed in field work resembles, on a whole, a field calculated theoretically.

2. Although the fields are always somewhat distorted, the varieties of these distortions may, to a certain degree, be systematized into groups of wavy, slanting, and curved fields.

After a description of the influence of topography and meteorological conditions, the authors conclude that a careful taking into consideration of all kinds of data obtained during the electrical research is necessary, and that it is indispensable, in addition to the survey of the equipotential lines even accompanied by the measurement of the gradient, to accomplish a supplementary work by measuring the specific resistivity of the upper layers of the soil, the specific resistivity of rocks and other layers which break the homogeneity of the field, as well as of the water in the swamps and basins scattered in the area under investigation. Levelling has, according to the authors, only secondary significance, but the influence of meteorological conditions under which the research work is performed is most important.--W. Ayvazoglou.

## AN ARTIFICIAL ELECTRIC FIELD WITH 21 PAIRS OF ELECTRODES

(In Russian)

By A. Petrowsky

Bulletin of the Institute of Practical Geophysics, Leningrad, No. 4, 1928, pp. 216-231.

Contents of the article:

1. General information.
2. Calculation of the potential.
3. Calculation of the equipotential lines.
4. Calculation of the longitudinal component of the electric force.
5. Calculation of the transversal component of the electric force.
6. Calculation of the value and direction of the total electric force.
7. Calculation of the longitudinal component of the magnetic force.
8. Calculation of the transversal component of the magnetic force.
9. Calculation of the value of the total magnetic force.
10. Calculation of the direction of the magnetic force.

In one of his previous articles, "Calculation of an artificial electric field," Petrowsky derived formulas and gave detailed schemes of the calculation of an artificial electric field. The present article examines the calculation of a square field having 21 electrodes on each of the two opposite sides.

The results of these calculations are disposed of in eight tables as follows:

I. A table of potential numbers.

II. A table of relative coordinates of the equipotential lines.

III. A table of longitudinal numbers of force.

IV. A table of transversal numbers of force.

V. A table of longitudinal magnetic numbers.

VI. A table of transversal magnetic numbers.

VII. A table of total magnetic numbers.

VIII. A table containing the angles of inclination of magnetic force to the direction of the lines of the field.

The eight figures given in the article represent:

1. The distribution of the coordinate axes and the numbering of lines and electrodes.
2. Theoretical distribution of equipotential lines in a square field with 21 pairs of electrodes.
3. A graph of longitudinal numbers of force.
4. A graph of transversal numbers of force.
5. A graph of longitudinal magnetic numbers of a square field with 21 pairs of electrodes.
6. A graph of transversal magnetic numbers.
7. A graph of the total magnetic numbers.
8. Theoretical distribution of the magnetic force in a square field with 21 pairs of electrodes.

In the continuation of this article, the author expects to give tables which will make possible the calculation of electrical and magnetic fields not only in the planes of the electrodes but also in space.

These tables will probably appear in the next issue (No. 5, 1929) of the Bulletin of the Institute of Practical Geophysics.--W. Ayvazoglou.

### UBER EINIGE GEOELEKRISCHE AUFNAHMEN AM RAMMELSBERG UND IM OBERHARZ

### (CONCERNING SOME GEOELECTRIC MEASUREMENTS ON THE RAMMELSBERG AND IN UPPER HARZ)

By Dr. A. Ebert

Metall und Erz, vol. 18, Sept., 1929, pp. 462-467.

The author compares geoelectric methods of prospecting with some others, especially with the gravimetric, magnetometric, and seismic methods, noticing briefly the advantages and disadvantages of each.

In the second part of the article Ebert describes the experiments with electric methods of prospecting, performed under the auspices of the recently created section of the Geological Division of the Prussian Geological Institution (Preussische Geologische Landesanstalt.)

The well-known ore deposit regions of the Rammelsberg and Upper Harz were chosen for the experiments.

The inductive method has been tried out especially, and the results of investigations are given in a series of maps and diagrams.--W. Ayvazoglou.

## 5. RADIOACTIVE METHODS

### ON THE METHODS OF MEASUREMENT OF SUBSTANCES POSSESSING WEAK RADIOACTIVITY BY MEANS OF $\alpha$-RAYS

(In Russian)

By V. Baranov

Vestnik du comité géologique, leningrad,
vol. 2, No. 7, 1928, pp. 37-41.

The measurement of radio elements in weakly radioactive ores (of the order of 0.01% $U_3O_8$ and less) by means of $\alpha$-rays is sometimes very desirable.

In these measurements a quick method of work, as well as constancy of natural dissipation inside of apparatus, is important. In order to eliminate the defects of electroscopes of usual types used for these measurements, Baranov constructed an apparatus by which a series of disadvantages could, to a certain degree, be avoided.

A schematical design of the apparatus is given in the article. The apparatus consists of a Wulf's electrometer provided with a cylindrical electrode 10 centimeters in length and 5 millimeters in diameter. The electrometer is turned upside down and is secured to an ionization chamber; the latter has the shape of a cylinder 16 centimeters in diameter and 10 centimeters in height. The bottom of the chamber can be opened or closed hermetically.

In the center of the bottom of the chamber is soldered a pipe through which the air is pumped out of the chamber. The constancy of the air current is maintained by means of a special regulator and is controlled by a rheometer. The air enters the chamber through to symmetrically placed pipes 20 centimeters long and 1.3 centimeter in diameter; these pipes represent cylindrical condensers and are provided with internal electrodes 16 centimeters long and 5 millimeters in diameter insulated by means of ebonite plugs. The electrometer is connected with a battery of 200 Clark's elements. According to the scheme of this connection shown in a figure, the ionization chamber remains unloaded. This arrangement makes it possible to change the materials to be investigated without the necessity of disconnecting the battery.

Less than two minutes is required for the taking of each reading.

The advantages of the apparatus are as follows:

1. Owing to the fact that the apparatus remains charged and the potential difference at the insulator of the electrometer does not exceed 1 volt during the measurement, the polarization of the insulator is not an essential influence.

2. Owing to the uninterrupted flowing of the air current through the apparatus during the measurement, the influence of the emanation of the material under investigation is greatly reduced.

3. For the same reason as given under (2) the influence of the ions in the air of the chamber is reduced and the change of the natural dissipation during the opening of the chamber is removed to a great degree.

4. The time necessary for taking measurements is reduced considerably, thus the importance of the fluctuations of natural dissipation from outside causes is lessened.

Several tables showing the results of observations made with this apparatus are given.--W. Ayvazoglou.

## APPARATUS WITH CLOSED AIR CURRENT FOR THE DETERMINATION OF RADIOACTIVITY OF MINERALOGIC COLLECTIONS

(In Russian)

By S. A. Artsybyshew and V. Pleshanova

Vestnik du comité géologique, Leningrad,
vol. 3, No. 8, 1928, pp. 35-39.

After a brief notice on the different defects of apparatus used for determining the radioactivity of ores in mineral collections, the authors describe a new very simple apparatus constructed by them: A box containing the samples to be investigated is put over a zinc sheet and covered with a square metallic chamber (cover) 55 by 55 by 27 centimeters in size. An electroscope, provided with a reading microscope, is fixed to the chamber; the electroscope is connected to a commutator in the form of a square wire frame. The upper part of the chamber has an opening through which a propeller is inserted; the propeller is put in rotation by means of an electromotor. Owing to this arrangement, a strong air current is obtained inside of the chamber, so that all dead spaced are eliminated.

This arrangement also makes it possible to reduce the size of the commutator and to raise it considerably above the bottom of the chamber; the capacity of the device can be reduced and becomes independent of the size of the samples to be investigated.

The capacity of the apparatus described is constant (with an accuracy of about 5%) and is equal to 20.7 centimeters in case a double wire-frame commutator is used, and to 13.6 centimeters for a single wire-frame commutator; the size of the commutator is 25 by 25 centimeters.

Four disks, each 5 centimeters in diameter, coated with a thin layer of $U_3O_8$ were used. The disks and the samples were distributed over the zinc sheet arbitrarily.

The distribution of the disks and samples is shown in diagrams, and the data obtained accordingly are given in tables.

The authors proved also that an active sample may be discovered easily by successive covering of the minerals with a piece of heavy cloth.

The results of the experiments are considered to be successful.--
W. Ayvazoglou.

## GRADUATION OF APPARATUS FOR THE MEASUREMENT OF RADIOACTIVITY

(In Russian)

By A. A. Lomakin

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1928, pp. 151-156.

In the present article Lomakin describes a simple and sufficiently accurate method for comparison of two capacities, one of which is the capacity of an $\alpha$- electroscope of the usual type.

The method of measurement is given in a scheme.

The graduation of the scale of the apparatus in volts is made, based on the following calculations:

From the formula for the strength of ionization current, $i = \frac{C(V_1 - V_2)}{9.10^{11} t}$ amperes, in which the capacity C is given in centimeters and the voltage drops $V_1$-$V_2$ in volts, it is evident that for the calculations of the strength of current not its absolute tension is important, but the change of the tension, $V_1 - V_2$, during the measurement.

The interval of tensions on the scales of very sensitive instruments is small, while a full tension necessary for producing saturated current is more or less large. Therefore, a simple comparison of the reading of the electrometer with the reading of the voltmeter for the full tension $V_1$ is not rational.

A comparatively small error in the determination of the full tension may become of great value for the comparatively small difference $V_1 - V_2$.

The author eliminates these defects by measuring the tensions $V_1 - V_2$ by a second very sensitive voltmeter. Therefore, the error in the readings of the first voltmeter which shows the tension of the initial point of the apparatus scale remains constant for the whole graduation and does not influence the calculation of the value of the current strength.

The arrangement is shown in a scheme.--W. Ayvazoglou.

## DEFINITION OF RADIUM IN RUSSIAN ORTHITES OF DIFFERENT ORIGIN

(In Russian)

By L. N. Bogoyavlensky

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1923, pp. 157-164.

Bogoyavlensky analyzed three patterns of orthites from pegmatite veins of Russian origin but from different ore beds; the determination of the radium has been made by using the emanation method.

Radium has been found in all patterns, but its quantity could not be brought in connection with the content of thorite. As radium in orthite is in a state of radioactive equilibrium with uranium, the orthite has been calculated according to the quantity of uranium.

The author concludes that if the dependency of the content of alkaline metals on radium and uranium is taken into consideration, it can be supposed that the latter is present in orthite as a definite chemical combination and not as a microcosmic ingredient.--W. Ayvazoglou.

## ANOMALIES OF THE PENETRATING EARTH RADIATIONS IN THE UKHTA OIL-BEARING REGION

(In Russian)

By L. N. Bogoyavlensky and A. A. Lomakin

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1928, pp. 165-178.

The Ukhta oil-bearing region is situated in the basin of the Pechora River (North Russia) along the Ukhta River. The oil deposits occupy a vast area of several tens of square kilometers. In this region the rocks of the Devonian era form a great anticlinal fold. The analysis of Ukhta region brine has proved that it contained elements of radium (the highest content being $7.6 \times 10^{-9}$ grams per liter). Investigations on the radioactivity of the deposits in the region were made in 1927. In addition to radium, mesothorium with all products of its dissociation was discovered.

It was found that the brine also contained protoxide combinations of iron which, in combination with the oxygen on the surface of the earth, were liberated in the form of fine ocher of different shades.

Investigations on penetrating earth radiations were made by means of a new electrometer.

The body of the apparatus used had walls 15 millimeters thick and the chamber could be closed hermetically. The volume of the closed chamber was 2,150 cubic centimeters. The authors investigated 44 points. Lead screens of a thickness up to 7.45 centimeters were used. The results of measurements are given in a table which shows that the intensity of radiation varied from 4.37 to 7 ions; that is, the variation reached 72 per cent. A map of radiometric survey based on the data obtained was prepared (given in a figure), and curves of equal intensities showing the values of 5.5, 6.0, 6.5, and 7 ions are drawn.

In the last part of the article the authors give the results of their study of radiation. They found that a point far from the accumulation of the radioactive sediments on the surface, the intensity of the radiations changed very little, and that the calculated coefficient of absorption was equal to 0.5, while the absolute values of the intensities were different. This indicated the insignificance of the quantity of soft radiations due to the radioactive upper strata of the soil.

The difference of absolute values of intensity at each point must, therefore, be assigned to the radiations penetrating from radioactive bodies situated at certain depths. The coefficient of absorption could not be determined by the authors; it diminished with the increase of the thickness of the lead screen.---W. Ayvazoglou.

# RADIOACTIVITY OF ASHES OF SOME ROCK OILS

(In Russian)

By L. N. Bogoyavlensky

Bulletin of the Institute of Practical Geophysics, Leningrad,
No. 4, 1928, pp. 311-314.

Bogoyavlensky describes the results of experiments performed by him to determine the radioactivity of ashes of rock oils. Samples from the Ukhta (North-Russia) oil-bearing region and the Maikop (Caucasus) region were taken. The choice of samples from regions so remote from one another was made because of the great difference of the radioactive phenomena of the brine of these two regions. While the brine from the Ukhta region contains a considerable amount of radium (up to $7.5 \times 10^{-9}$ grams per liter), that of the Maikop region does not contain radioactive elements at all.

For the determination of the radioactivity of ashes about 200 grams of rock oil were slowly evaporated and the residue burned, weighed and measured in an $\alpha$-electroscope. The activity of ashes is expressed in units of $U_3O_8$.

The results of the experiments may be seen from the following table:

| ORIGIN OF THE SAMPLES | | CONTENTS OF ASHES IN PER CENT | RADIOACTIVITY IN UNITS OF $U_3O_8$ |
|---|---|---|---|
| Ukhta oil-bearing region | No. 1 | 0.03 | 0.014 |
| | No. 2 | 0.098 | 0.003 |
| Maikop region | No. 3 | 0.027 | 0.020 |

The figures show that the ash activity of oil samples proved to be in an inverse ratio to the contents of ashes. The analysis of ashes performed in order to discover the radioactive emanations showed a complete absence of radium and thorium X.

The author supposes that the activity of ashes is caused by the dissociation products of emanation (polonium) which are produced as a result of the great absorptive capacity of oil with relation to the radioactive emanations.

The experiments which are so far of a preliminary character, show, of course, that the active products are not connected with ashes but with the rock oil itself, as in the first case radium and thorium X would be discovered by the emanation method.--W. Ayvazoglou.

## 6. GEOTHERMAL METHODS

### MÉMOIRE RELATIF À LA PRISE DE LA TEMPERATURE DANS LES SONDAGES

### (NOTE CONCERNING THE TAKING OF MEASUREMENTS OF TEMPERATURE IN THE BOREHOLES)

By I. Atanasiu

Annales des mines de Roumanie,
No. 7-12, July-December, 1928, pp. 219-225.

The purpose of the present article is to find out the conditions under which the temperature measurements can be used as a means of determining occlusions produced by cementation.

The author divides the article into the following sections:

1. General considerations on the variation of the temperature in the ground.
2. What can be obtained by taking the measurements of temperature in the boreholes?
3. Conditions which the thermometers must satisfy.
4. Propositions for applying the measurements of temperature in boreholes.

In section one, Atanasiu gives a formula according to which a geothermic degree--that is, the number of meters at which the thermometer must be lowered in order to reach an increase of temperature of 1 degree--can be calculated: $Gr = \frac{h}{t-to}$. Here Gr is the geothermic degree, *h* the depth at which the temperature is measured, *t* the temperature obtained, and *to* the mean annual temperature of the ground.

In section two the author gives a table of measurements taken at different depths:

| Oil Fields | Depth of Borehole | Temperature | Geothermic degree | Remarks |
|---|---|---|---|---|
| 1. Filipesti | 886 | $37.4^\circ$ | 32.6 m. | Without oil. |
| 2. Campina | 831 | $37.4^\circ$ | 30.5 m. | In boring. |
| 3. Moinesti | 900 | $33.7^\circ$ | 36.4 m. | Gas, water. |
| 4. Luncacesti-Zames | 480 | $21.5^\circ$ | 38.4 m. | Surface water. |

If the occlusion is not good the water coming from above, which is colder, will cause the lowering of the temperature, and the geothermic degree calculated will accordingly show a higher value than the normal one for the region.

This is plainly shown in the table in the case of Luncacesti-Zames.

Temperature measurements may be useful for the determination of the origin of water appearing in the boreholes. For example, if the occlusion is no longer perfect, it is often difficult to be sure whether the water is originally in the deposit itself or comes from above.

By introducing a thermometer the source of the water can be established with surety, for the temperature will remain equal or be higher in the first case and will drop in the second case.

Section three deals with the construction and protection of thermometers for use measurements at great depths. The author proposes to manufacture the following types:

Type I. With a scale of from 10 to 30° for depths up to 500 meters.

Type II. With a scale of from 25 to 45° for depths from 500 to 1,000 meters.

Type III. With a scale of from 40 to 60° for depths from 1,000 to 1,500 meters.

In the last section Atanasiu proposes that temperature measurements be made obligatory; if taken as often as possible they will furnish valuable material which may serve for general orientation.--W. Ayvazoglou.

## DETERMINATION OF GEOTHERMAL GRADIENTS ON OIL STRUCTURES

By the American Petroleum Institute

Oil and Gas Journal,
Nov. 14, 1929, pp. 105-106.

This paper is a report of the research division of the American Petroleum Institute on the progress toward determining geothermal gradients in oil fields.

The report concerns the Oklahoma, Texas, Santa Fe, and Long Beach fields.

Oklahoma.-One of the most outstanding facts in connection with earth temperatures in Oklahoma is the apparent agreement of the dip of the isothermal surfaces and the formations.

The reciprocal gradients vary widely from area to area, but show small variations within the same area. The lowest gradient found was 1° F.

in 149 feet (Healdton); the highest, 1° F. in 36½ feet (Glenn Pool).

Data collected in two fields, Haverhill, Kans., and Glenn Pool, Okla., indicate that the temperatures are higher at corresponding depths in wells located in the producing area than in wells located outside the producing area.

Texas.-Temperature measurements were obtained from wells in all parts of the State. A complete report on the results of the work has been submitted to the American Petroleum Institute. The relationship between the normal rate of increase of temperature and the structure is especially noteworthy in salt domes and in anticlinal structures carrying much underground water.

Temperature measurements obtained in salt domes were especially interesting. The following results were obtained in the Humble Salt Dome, Harris County:

1. At equal depths temperatures are higher on the top of the dome than on the flanks.
2. Rate of increase in the temperature with depth is relatively greater on top of the dome than on the flank.
3. The difference in temperature at the same depth and the greater temperature gradient on top of the dome are found not only near the salt but also above the salt (at depths) of 100 and 250 feet).
4. Drill holes on top of the salt domes have approximately the same temperatures at equal depths.

Santa Fe Springs Field.-Fourteen wells were measured, bringing the total number tested to 33. The following conclusions were drawn from the computed data:

1. Depth temperature relations are irregular as compared with other fields;
2. Shallow temperatures vary within rather wide limits. Temperatures at a depth of 100 feet range from 65.9 to 74.9° F.
3. The elevations at which a temperature of 100° F. occurs define an irregular isothermal surface.
4. Reciprocal gradients computed over the depth interval 100 to 2,000 feet, vary from 47.5 to 56.6 feet per degree.
5. Reciprocal gradients recomputed over the same depth interval after eliminating certain abnormal temperatures, show a less pronounced irregularity.

6. The lack of a satisfactory relation between geothermal conditions and structure in this field may be attributed to the following three factors:

   a. The variation of the gradients within the narrow limits of only a few feet per degree of temperature;

   b. The unusual conditions of development and production involving the very close spacing of wells and the flow of large quantities of gas and oil under high pressure; and

   c. Natural conditions of ground-water circulation causing the establishment of abnormal shallow temperatures.

Long Beach Field.-Nineteen wells were measured in this field, making a total of 43 completed. The total variation of depth to a 100° isothermal surface is about 200 feet and of reciprocal gradients about 8 feet per degree. The mean isothermal depth is 1,534 feet and the mean reciprocal gradient about 53 feet per degree Fahrenheit.--W. Ayvazoglou.

## TEMPERATURE GRADIENT IN THE PECHELBRONN OIL-BEARING REGION, LOWER ALSACE:

## ITS DETERMINATION AND RELATION TO OIL RESERVES.

By I. O. Haas and C. R. Hoffmann

Bulletin of the American Association of Petroleum Geologists,
vol. 13, No. 10, October, 1929, pp. 1257-1275.

The authors summarize their experience in making temperature measurements in oil wells and consider whether it is possible to ascertain the existence of petroleum on the basis of a smaller or a larger temperature gradient.

The article is divided into the following paragraphs:

1. Description and discussion of thermometers used.
2. Possible sources of error in temperature measurements.
3. Carrying out of temperature measurements.
4. Calculation of temperature gradient.
5. Criticism of results obtained.
6. Application of results obtained.
7. Attempt at an explanation of temperature variations.

In the abstract of the article given by the authors they say:

"Numerous temperature measurements have been made during the last 10 years in the Pechelbronn oil-bearing region, to aid in the search for petroleum deposits.

However, the results of the study of approximately 500 measurements clearly show that the isogeotherms are influenced primarily by the tectonic structure of the Rhine Valley graben. They show a nearly regular rise from the edges to the central part of the graben; also not uncommonly they approach one another. Such increase of temperature is especially marked in the fault zones.

Seemingly the isotherms are not influenced by larger or smaller oil accumulations; therefore, the presence of oil can not be looked upon as the cause of the relatively elevated temperature.

It is perhaps possible to explain the rise of temperature toward the central part of the graben by a gradual change in the nature of deposits. Coarse-grained sandy beds of the graben edges are gradually replaced toward the center by increasingly finer sands, and finally by finely laminated marls. It is possible that these finest deposits act as a sort of protective cover against the loss of heat. This suggestion would also explain the increase of temperature and the accumulation of heat along the faults as it is possible to suppose a stronger increase of temperature in the direction of the dislocation in the strata. This suggestion is strengthened by the fact that the especially high horsts are characterized by temperature maxima on the isothermal map."

A map of the Northern Pechelbronn oil fields showing the temperature curves at a depth of 400 meters and their relation to productive oil zones, as well as three cross sections of the oil fields showing underground temperature curves, are given.

A list of publications on temperature measurements is attached.--W. Ayvazoglou.

## LA TEMPÉRATURE DES EAUX PROFONDES DE LA RÉGION PARISIENNE

## (THE TEMPERATURE OF DEEP WATERS IN THE REGION OF PARIS)

By P. Lemoine and R. Nassans

Bulletin du muséum national d'histoire naturelle,
series 2, vol. 1, No. 4, May, 1929, pp. 264-280.

In this article the authors sum up a series of data obtained on thermometrical measurements of deep waters in wells bored in the region of Paris. They consider these data to be of interest, notwithstanding the lack of certainty that the temperatures taken are of sufficient correctness.

After a brief description of the process by which the geothermic degree (Dg) should be calculated and the influence of the possible errors on its value established, the authors give some data concerning the varieties of the geothermic degree in different places, as determined by the following scientists:

Gensanne, who made experiments in 1740 near Belfort, found, according to Becquerel:

At a depth of 101 m. - - - - 12.5°
Do. 206 m. - - - - 13.1° Dg (101-206) = 17.5 m.
Do. 308 m. - - - - 19° Dg (206-308) = 17.6 m.
Do. 433 m. - - - - 22.7° Dg (308-433) = 33.8 m.

De Saussure (1785), who took measurements in Switzerland at wells bored in searching for rock salt, established these measurements:

At a depth of 108 m. - - - - 14.4°
Do. 183 m. - - - - 15.6°
Do. 220 m. - - - - 17.4°

Corder calculated the geothermic degrees (Dg) given for the following places:

Cormeaux - - - - - - - - - - - Dg = 36 m.
Littry - - - - - - - - - - - - Dg = 19 m.
Decize - - - - - - - - - - - - Dg = 15 m.

By comparing a series of data taken in the wells in Paris and its vicinity the authors found the mean value of the geothermic degree for the basin of Paris to be 34 meters.

Great anomalies were observed in Pressagny-l'Orgueilleux. The temperatures of waters at a depth of 70 meters were found to be 17°, although their normal temperature should be about 13°.

The authors note especially that, by assuming one geothermic degree to be equal to 34 meters, the waters of a temperature of 17° should be at a depth of about 204 meters, but none of the wells situated in the region to the northwest of Pressagny was so deep as that.

Whether this anomaly can be explained by the quick rising of deep waters flowing from the region of Paris to Pressagny remains unsolved, and the conclusion of the authors that the waters in Pressagny are supplied from south and east seems to be the most probable one.

Anomalies observed in several other wells were less important.

In several places waters of a temperature lower than the normal one have been observed. The authors, who called these waters "hypothermal" waters, could not find any explanation for this hypothermality.

A long list of authors giving the data for the temperatures at different places is added to the article.--W. Ayvazoglou.

## 7. UNCLASSIFIED METHODS

### LES METHODES GEOPHYSIQUES DE PROSPECTION

### (GEOPHYSICAL METHODS OF PROSPECTING)

By Georges-Albert Boutry

La revue pétrolifère, Paris,
No. 325, June 15, 1929, pp. 821-825.

In this introductory article Boutry examines the question of geophysical methods of prospecting, especially with regard to prospecting for oil.

A brief discussion of the following subjects is included:

1. Hypotheses on the origin of oil.
2. Increasing difficulties for prospecting oil.
3. Oil-bearing regions of the world.
4. Principal favorable structures of the terrane; and
5. Geological prospecting and its insufficiency.

After giving a general outline of the principles of the methods and their application the author concludes:

"I will try to show that, although the efficiency of geophysical methods of investigation has often been discredited or, on the contrary, exaggerated, it remains true that geophysical prospecting has high value and power and that the use of these methods will become in the very near future absolutely necessary for all kinds of prospecting by which a success is to be obtained."

This introductory article is followed by a series of articles, the purpose of which is to show that the problems for the research of salt domes, faults of monocline structure, anticlines, etc., can be solved by geophysical methods; the possible degree of the solution is examined.

The whole work is arranged according to the following classification:

I. Examination of gravity anomalies: pendular method, torsion balance method.

II. Examination of magnetic anomalies.

III. Examination of electrical anomalies by means of direct current and alternating current.

IV. Examination of elastic anomalies; study of the velocity of propagation of shocks; measurement by sound; measurement by ultrasound.

V. Anomalies of geothermal gradient. Propagation of radiations of short waves in the rocks. Radioactivity in oil areas.

All the articles are provided with many figures and diagrams and a long list of literature is given.--W. Ayvazoglou.

## GEOPHYSIKALISCHE ZUSAMMENHÄNGE ZWISCHEN OSTALPEN UND BÖMISCHER MASSE

## (GEOPHYSICAL RELATION BETWEEN THE EAST ALPS AND THE BOHEMIAN MASSES)

By Robert Schwinner

Gerlands Beitrage zur Geophysik,
Band 23, Heft 1, 1929, pp. 35-92.

Geologic-petrographic considerations lead to the theory that an old mountain-system (trending from north to south) is hidden under the Calcareous Alps (striking from east to west) and makes a connection between the Bohemian mass and the Central Alps. The examination of the measurements of gravity gave in the first place the startling fact that the idea furnished from the doctrine of isostacy (particularly in the version of Airy) of the deeper part of the crust of the earth must be essentially modified with regard to the Alps. That the 50-kilometer thick flakes of the crust consisting of gneiss (Sial) are dipping more or less, according to the load of the mountain formation in the heavy basis magma (Sima) is most sufficient to explain the observed anomalies of gravity; the high gradients demand flatter disposed disturbing masses, and these may be suggested, according to geological and geophysical data, as branches of the subjacent heavy "Sima" rising up nearly to the surface through the fissures between the blocks of "Sial."

Such fissures correspond to the principal dislocations of the mountain ranges of this age (border of the Alps, the zone of graywacke of Upper Styria). But even the corresponding structure and distribution of masses of the old mountain chains denuded at the surface and entirely masked by younger covering mountains are preserved in the substratum.

The crossing of the trend lines of the two mountain systems of different age, which can be read in the isograms, confirms the geologic thesis mentioned at the top. Difference in material involves different elastic reaction. Therefore, at earthquakes which are frequent and known on account of their paradoxial extension, these fissures, and indeed those lines which are geologically postulated and known by the disturbance of gravity, can lead, as leading plains of "conducted waves" (Uller), the seismic energy as "transversal quakes" under the Calcareous Alps tothe Bohemian mountain mass; or, on the other hand, can stop their spreading by acting as "seismic bars" in the strike of the Alps.--Author's abstract.

## GEOPHYSICS

By G. Angenheister

Terrestrial Magnetism,
vol. 34, No. 1, March, 1929, p. 62.

H. D. Harradon gives a brief review on the first part of the twenty-fifth volume of Wein and Harms, Handbuch der Experimentalphysik, which bears the general title of "Geophysik." The authorship of this work has been shared by six prominent specialists working under the general editorship of G. Angenheister.

> "The work is divided into seven main sections. In the opening section, A. Defant gives a general discussion of the physics of the atmosphere, considered under the two headings of Statics and Dynamics. The two following sections on tidal vibrations of the atmosphere and atmospheric optics are by J. Bartels and W. Milch, respectively. The fourth section contains a general discussion of atmospheric electricity by H. Benndorf. Next follows a treatment of northern lights by L. Vegard; he describes the auroral phenomena with reference to form and altitude, relationship with terrestrial magnetism and sunspots, the various theories regarding polar lights and the physical investigations connected therewith, the spectrum of the aurora, and the conditions of the upper layer of the atmosphere, and concludes with an account of an experimental test of his own hypothesis. K. Büttner contributes a section on the penetrating radiation. G. Angenheister and J. Bartels conclude the volume with an essay on the earth's magnetic field, treating the subject under the following headings: Instruments and methods of measurements; the permanent field and secular variation; periodical variations and magnetic activity; magnetic disturbances. The volume is provided with a convenient subject and author index."

The German title of the book is as follows:

Angenheister, G. - Geophysik. I-Teil, unter der Redaktion von G. Angenheister, J. Bartels, H. Benndorf, K. Büttner, A. Defant, W. Milch, L. Vegard. Wien-Harms, Handbuch der Experimentalphysik, Band 25, I Teil, Leipzig. Akademische Verlagsgesellschaft m.b.H., 1928 (XIV + 699 mit 185 Abbildungen).--W. Ayvazaglou.

## POSSIBILITIES FOR GEOPHYSICAL PROSPECTING OF PLACERS

(In Russian)

By K. P. Kosin

Gorny Journal, Moscow, No. 4, April, 1929, pp. 548-553.

So far very little attention has been paid to the possibility of geophysical prospecting of placers.

Referring to two articles which appeared in the Engineering and Mining Journal Press (A. Gibson, Magnetometric Determinations Applied to

Placer Mining," vol. 144, No. 25, 1922, and K. Laylander, Magnetometric Surveying as an Aid in Exploring Placer Ground, vol. 121, No. 8, 1926), Kosin draws the conclusion, based on the results of investigations obtained by Gibson and Laylander, that geophysical methods, especially the magnetometric, can and should be used in certain cases. Of course some favorable conditions are necessary. Therefore, geophysical prospecting must be accompanied by drilling and digging, as the latter work may serve not only for the verification of the results but also as material for the interpretation of them.

According to the author, successful results may be obtained--for example, when a placer deposit already contains 0.5 per cent of magnetite.

No geophysical prospecting of placers has been tried so far in the U.S.S.R.

In the last part of the article Kosin discusses theoretically the possibility of using electrical and especially seismic methods for prospecting placer deposits. He concludes that in order to enlarge the sphere of geophysical prospecting for placer deposits a detailed examination of technical possibilities is desirable.--W. Ayvazaglou.

## URGES LABORATORY DEEP IN THE EARTH

By Prof. H. Shapley

The New York Times, Nov. 27, 1929, p. 14.

This article is an address delivered by Prof. Harlow Shapley, director of the Harvard Observatory, before the American Geographical Society in New York.

Speaking on what he termed "the third dimension in geography," Shapley asserted that failure to study the interior of the earth beyond a small depth close to the surface constitutes a very serious hiatus in scientific inquiry. For example, by boring deep into the earth it might prove possible to tap the earth's internal source of heat for utilitarian purposes; the knowledge of the mineral wealth of the region bored would be important besides. Therefore, Shapley urged the establishment of a series of laboratories, called by him "Plutonic laboratories," at various depths along a vertical shaft. The installation of such laboratories, although a scientific adventure of great difficulty and expense, would mark an important epoch in man's attempt to understand the earth.

These laboratories may contribute to the knowledge of many important fields in geophysics and astronomy, such as: Investigations of the irregularities in the length of the day and the pulsation of the earth's crust; the thermogradient of the earth and its bearing on the origin of the earth and its source of heat; the nature of the radio activity in the rocks and its variation with depth; studies of earthquake waves; experiments on relativity--for example, the problem of the "ether-drag;" and the problem of the floating of the continents--a test of phases of the Taylor-Wegener hypothesis which holds that America is drifting away from the African and Eurasian continents.

Many smaller scientific problems, such as experiments on living organisms in situations free from cosmic radiation, study of gravity variation and the lunar tides in the body of the earth, as well as the dating of the ice ages and the interglacial periods could be studied also.

Part of Prof. Shapley's address was devoted to a discussion of the earth-moon system.

Pointing out that both theory and observation indicate that the moon has been gradually receding, this recession being about 7 feet per century, Prof. Shapley declared: "The future of the earth-moon pair seems to be that the day will grow gradually longer, and also the month, until they are the same, at about 47 of our present days. This will require, according to Jeffreys, some 50,000,000,000 years. After this, the moon will again approach the earth gradually until it is broken up by tidal disruption just before it gets to the earth's surface. This remote catastrophe may result in a ring of fragments circulating around the earth much like the ring around Saturn."--W. Ayvazoglou.

## A BRIEF REVIEW OF ARTICLES APPEARING IN THE TWO FIRST NUMBERS OF THE "BOLETIN DE LA ASOCIACION GEOFISICA DE MEXICO."

Vol. 1, Nos. 1 and 2, July and August, 1929, pp. 5-8, 33-52.

The bulletin issued recently by the Geophysical Association in Mexico, the two first numbers of which (July and August, 1929) have just appeared, contains several articles dealing with geophysics and their application in prospecting for minerals and oil.

The following articles may be mentioned:

1. Importance of Studying Geophysics (Importancia del estudio de la geofisica) (No. 1), by Eng. R. Monges L. The author gives a brief description of the development and study of geophysical methods of prospecting in different aountries.

2. Geophysics as Applied to Minerals and Oil (La Geofisica aplicada a la minera y al petroleo) (No. 2), By R. Monges L. This is a brief description of different geophysical methods of prospecting (gravimetric, seismic, electrical, magnetic, radioactive, acoustical, and thermic). Preferences for application of one or another method in the search for minerals and oil are discussed, and the connection of geophysics with geology is mentioned.

3. Physical Principles of the Gravimetric Method of Prospecting, by P. Nikiforov (see Geophys. Abs. 2). This is a translation of Nikiforov's article from Russian into Spanish made by Prof. Eng. Juan Korzujin. (The article is to be continued.)

4. Application of Geophysical Methods of Prospecting in Practice (El Empleo de metodos geofisicos en la practice), by Eng. Kurt Ritzau.

In the part of the article given in No. 2 of the Boletin, Ritzau discusses questions concerning the objects of application of geophysics and the fundamental principles of each method of geophysical prospecting. The article is to be continued.

A list of members of the recently created Geophysical Association of Mexico is given in issue No. 2 of the bulletin.--W. Ayvazoglou.

### SCIENTIFIC IMPORTANCE OF APPLIED GEOPHYSICS

(In Russian)

By V. A. Gorsky

Transactions of the Fourth Meeting of Russian
Academic Organizations Abroad, 1929, pp. 85-91.

In the article Gorsky expresses his opinion on the desirability of unifying the methods used for studying the earth's crust with the new means offered by geophysics. Taking into consideration that (1) the natural constant static fields of force and conditions of the geoid as a whole (gravitation, magnetism, electricity, heat and radioactivity) and (2) the artificial, changeable dynamic fields of force (electromagnetic and elastic), are known theoretically under the condition that the geoid is a homogeneous body, determination of the geological reasons for the deformations of the normal fields caused by the heterogeneity of the earth's crust can be made by measuring at different points of the surface of the earth the values characterizing these fields.

After briefly stating how these geophysical means may be applied, Gorsky concludes that with the aid of systematic geophysical researches on a large scale, the structure of the geoid, laws of the formations, and the complicated relations of different factors in the process of the movement and life of the earth's crust can be studied. The author proposes to unify this study into a special science--"lithospherology."

Being closely connected with the problems and sphere of work of geophysics, geology, and geochemistry, lithospherology may unite all these separate sciences into a definite and harmonious systematic study of the complicated relations existing in the earth's crust.--W. Ayvazoglou.

## 8. GEOLOGY

### DECOUVERTE DE PETROLE DANS LA REGION DE L'OURAL

(DISCOVERY OF OIL IN THE REGION OF THE URAL)

Editorial Note

La revue petrolifiere, Paris,
Nos. 324 and 329, 1929, pp. 779 and 961.

The discovery of extremely vast oil deposits in the region of the Ural near Tchussovskie Gorodki, about 50 kilometers from the city of Perm, is reported. The importance of this discovery is very great not only on account of the richness of oil (estimated by Prof. Strijev at about 300 millions of tons) but also because of its geographical location in the center of a highly developed industrial, especially metallurgical, region. The ability to transport the oil to all places of the U.S.S.R. by using the big rivers Tchussovaya, Kama, and Volga is a very favorable feature besides. Two and one-half millions of roubles have already been appropriated by the government for the accomplishment of detailed investigations.

The data obtained by the analyses of different samples of oil discovered recently are as follows:

|  | Per cent |
|---|---|
| Gasoline - - - - | 20 |
| Kerosene - - - - | 12 - 15 |
| Oil-gas - - - - - | 12 - 20 |

The remainder is bituminous residue.

The gasoline is rich in aromatic hydrocarbons, the characteristic properties of which are on initial boiling point of 66° and of final point of 175°; 31 per cent evaporates at 100° and 93 per cent at 160°.--W. Ayvazoglou.

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